THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Impact of Increasing Temperatures on *Dionaea Muscipula*: An Analysis of Possible Climate Change Risk

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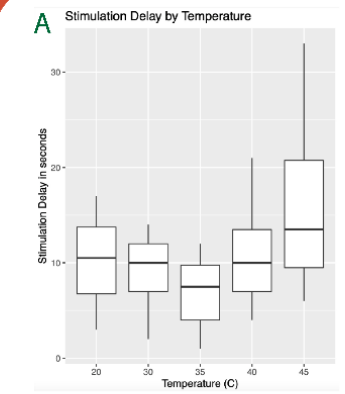
Introduction

Venus flytraps (*Dionaea muscipula*) are carnivorous plants native to the wetlands and sandhills of Eastern North & South Carolina. Thriving in nitrogen and phosphorus-poor environments, these plants have evolved unique traps which allow them to supplement their diets with small prey items such as ants, spiders, and beetles. Given the importance of prey capture to the flytraps' ability to thrive, we wanted to explore the impact of increasing temperatures on *Dionaea's* reaction speeds, which determine whether a prey-catching attempt is successful. Through our research, we wanted to discover how trap reaction speeds vary with environmental temperature, and if the flytraps are able to adapt to higher temperatures after continued exposure. Given that *Dionaea's* natural temperature range is 21-35°C, we hypothesized that trap reaction will be optimal within this range, and that heat stress will reduce reaction ability in temperatures exceeding 35°C. If higher temperatures are detrimental to flytrap success, we believe that this already threatened species should be reconsidered for inclusion in the Federal Endangered Species list as climate change poses a rising risk.

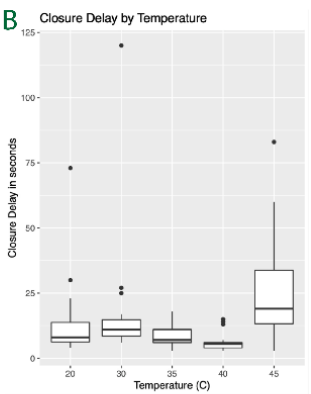
Further Research

- Experiments below natural temperatures (21-35°C) into 15°C, 10°C & 5°C: does trap function gradually decrease paralleling temperature?
- What extreme temperatures can plants tolerate before becoming unresponsive? Higher than 40°C, 50°C? Lower than 5°C?
- Similar stimulation and closure delay tests performed on wild trap plants. Create comparison to in-lab conditions - are naturally occurring plants more adapted to temperature changes?

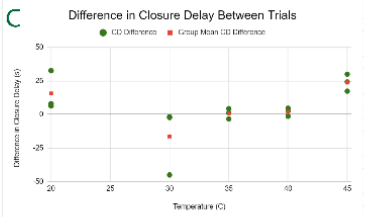
Lab-grown (left) and wild (right) venus flytraps



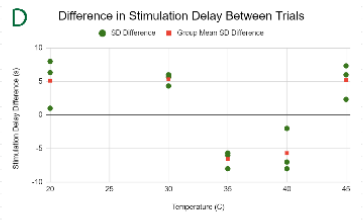
A. Delay in reaction to stimulation shows an increase as temperature exceeds natural range.



B. Extreme temperature exposure results in extended closure delay.



C. Individuals experienced either an increase in delay or very little change for closure times between trials.



D. A strong trend in stimulation delay was not reflected in data between trials.

An individual flytrap being manually stimulated to closure by a probe.

Methods

- Prior to experimentation, our venus flytraps were kept in standardized conditions consisting of nourishment from deionized water and exposure to fluorescent lighting.
- Venus flytraps were prepared for experimentation by random sorting into 5 treatment groups of 3 individuals each, and were given identifying numbers.
- At the start of each group's testing period, individuals were placed in a clear tub with new deionized water and moved into an incubator, which was maintained at the testing temperature for a week-long period.
- The pH and dissolved oxygen content of the water was recorded before testing began and on each stimulation testing day.
- Trap closure speeds for each individual were tested twice during the temperature exposure period. 3 traps were tested on each individual per testing day. Triggering the same trap more than once was avoided.
- Trap closure was tested by continuous manual stimulation of the trap's internal trigger hairs using a metal probe, which was concluded after the first sign of reaction. The traps were filmed in slow-motion video, and resulting footage was analyzed to determine initial reaction time and closure time.

Results and Discussion

The figures above depict the positive correlation between increasing temperature exposure and reaction delays. During our experimentation, we found that the population exposed to the 45°C treatment had the longest average reaction delay, while those exposed to treatments closer to their natural temperature range had faster reaction times. Overall, stimulation delays for all populations had a larger range of time values than closure delays, but the increasing trend with respect to temperature is still clear for both delay variables. Comparing data from our initial and secondary testing days, individuals experienced either an increase in delay or very little change for closure times, with the exception of treatment group B (30°C), which reacted faster during Trial 2. There was not a strong trend in stimulation delay differences across trials, but the trial difference data can inform our inferences of the overall group performances. This data supports our hypothesis that exposure to temperatures outside of their natural range would impact the reaction speeds of venus flytraps. Based on our results, we believe that *Dionaea muscipula* is at increased risk of impact from rising temperatures and should be considered for inclusion in the Federal Endangered Species List as climate change poses a rising threat.

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